PESTICIDE SURFACE WATER REPORT

SEPTEMBER 2002 SAMPLING EVENT

Richard J. Pfeuffer
Francine Matson
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL 33406

Pesticide Monitoring Project Report
September 2002 Sampling Event

Executive Summary

As part of the District's quarterly ambient monitoring program, unfiltered water samples from 39 sites were collected from September 16 to September 18, 2002, and analyzed for over sixty pesticides and/or products of their degradation. The herbicides ametryn, atrazine, bromacil, diuron, hexazinone, norflurazon, prometon, and simazine, along with the insecticides/degradates atrazine desethyl, atrazine desisopropyl, ethyl chlorpyrifos, diazinon, ethion, and metalaxyl were detected in one or more of these surface water samples.

The ethion concentration of 0.023 µg/L at GORDYRD exceeds the acute and chronic toxicity level (0.02 and 0.003 µg/L, respectively) for *Daphnia magna* calculated according to promulgated procedure (FAC 62-302.200). *Daphnia magna* is a sensitive indicator species for aquatic macroinvertebrates. The only chlorpyrifos ethyl concentration detected (0.085 µg/L at S2), should not have an acute, detrimental impact on fish. However, for aquatic invertebrates, these levels are greater than the calculated acute and chronic toxicity (0.03 and 0.005 µg/L, respectively) for *Daphnia magna*. The only diazinon concentrations detected (0.053 µg/L at S2), should not have an acute, detrimental impact on fish. However, for aquatic invertebrates, these levels are greater than the calculated chronic toxicity (0.04 µg/L) for *Daphnia magna*. For these compounds, at these levels, long term exposure can cause impacts to macroinvertebrate populations, but the pulsed nature of agricultural runoff releases to the canal system precludes drawing any conclusions about the effects of long term average exposures.

The compounds and concentrations found are typical of those expected from intensive agricultural activity.

Background and Methods

The District's pesticide monitoring network includes stations designated in the Everglades National Park Memorandum of Agreement, the Miccosukee Tribe Memorandum of Agreement, the Lake Okeechobee Operating Permit, and the non-Everglades Construction Project (non-ECP) Permit. The District's canals and marshes depicted in Figure 1 are protected as Class III (fishable and swimable) waters, while Lake Okeechobee is protected as a Class I drinking water supply. Water Conservation Area 1 (WCA1) and the Everglades National Park are also designated as Outstanding Florida Waters, to which anti-degradation standards apply. Surface water and sediment are sampled quarterly and semiannually, respectively, upstream at each structure identified in the permit or agreement.

Sixty-four pesticides and degradation products were analyzed for in samples from 38 of the 39 sites (Figure 1). Due to the extensive aquatic vegetation coverage at S191, a surface water sample was not obtained. The analytes, their respective minimum detection limits (MDL), and practical quantitation limits (PQL) are listed in Table 1. All the analytical work is performed by the Florida Department of Environmental Protection (FDEP) Central Laboratory in Tallahassee Florida. The reader is referred to the *Quality Assurance Evaluation* section of this report for a

summary of any limitations on data validity that might influence the utility of these data.

Each pesticide's description and possible uses and sites of application are taken from Hartley and Kidd (1987). The Florida Ground Water Guidance Concentrations (FGWGC) (FDEP, 1994) are listed to provide an indication at what level these pesticide residues could possibly impact human health, based on drinking water consumption or other routes of exposure (e.g., inhalation, ingestion of food residues, dermal uptake). Primary ground water standards are enforceable ground water standards, not screening tools or guidance levels. To evaluate the potential impacts on aquatic life, due to the pulsed nature of exposure, the maximum observed concentration is compared to the Criterion Maximum Concentration published by the USEPA under Section 304 (a) of the Clean Water Act, if available, or the lowest EC_{50} or LC_{50} reported in the summarized literature. This summary covers surface water samples collected from September 16 to September 18, 2002.

Findings and Recommendations

At least one pesticide was detected in surface water at 31 of the 38 sites. The concentrations of the pesticides detected at each of the sites are summarized for the surface water in Table 2. All of these compounds have previously been detected in this monitoring program.

The above findings must be considered with the caveat that pesticide concentrations in surface water may vary significantly in relation to the timing and magnitude of pesticide application, rainfall events, pumping and other factors, and that this was only one sampling event. The possible long term or chronic toxicity impacts are also reported based on the single sampling event and do not take into account previous monitoring data.

Usage and Water Quality Impacts

Ametryn: Ametryn is a selective terrestrial herbicide registered for use on sugarcane, bananas, pineapple, citrus, corn, and non-crop areas. Most algal effects occur at concentrations > 10 µg/L (Verschueren, 1983). Environmental fate and toxicity data in Tables 3 and 4 indicate that ametryn (1) is lost from soil relatively easily by leaching, surface adsorption, and in surface solution; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Additional fish toxicity data includes a 96 hour LC_{50} of 14.1 mg/L for goldfish (Hartley and Kidd, 1987). The ametryn surface water concentrations found in this sampling event ranged from 0.0099 to 0.12 µg/L. Using these criteria, these surface water concentrations should not have an acute, detrimental impact on fish or aquatic invertebrates.

Atrazine: Atrazine is a selective systemic herbicide registered for use on pineapple, sugarcane, corn, rangelands, ornamental turf and lawn grasses, and non-crop areas. Environmental fate and toxicity data in Tables 3 and 4 indicate that atrazine (1) is easily lost from soil by leaching and in surface solution, with moderate loss from surface adsorption; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Additional fish toxicity data include a 96 hour LC_{50} of 76 mg/L for carp, 16 mg/L for perch and 4.3 mg/L for guppies (Hartley and Kidd, 1987). Also, in a flow-through bioassay, the maximum acceptable toxicant concentration (MATC) of atrazine was 90 and 210 µg/L for bluegill and fathead minnow (Verschueren, 1983). The atrazine surface water concentrations found in this sampling event at

23 of the 38 sampling locations, ranged from 0.0098 to 0.90 μg/L. Using these criteria, these levels should not have an acute or chronic detrimental impact on fish or invertebrates.

Atrazine desethyl (DEA) and atrazine desisopropyl (DIA) are biotic degradation products of atrazine. These degradation products are both persistent and mobile in water; however, DEA is more stable and the dominant initial metabolite. Since DEA and DIA are structurally and toxicologically similar to atrazine, the concentrations of total atrazine residue (atrazine + DEA + DIA) may also be a significant consideration in the surface water environment. The DEA to atrazine ratio (DAR), on a molar basis, has been suggested as an indicator of nonpoint-source pollution of groundwater (Adams and Thurman, 1991) and as a tracer of ground water discharge into rivers (Thurman et al., 1992). Goolsby et al. (1997) determined that low DAR values, median <0.1, occur in streams during runoff shortly after application of atrazine. Higher DAR values, median about 0.4, occur later in the year after considerable degradation of atrazine to DEA has occurred in the soil. The low DAR ratio (0.1) at the locations where both atrazine and DEA were detected, suggests minimum degradation of atrazine (Table 5). However, these general guidelines were developed based on observations in Midwest watersheds in northern temperate climates with different soil and water management regimes as well as higher atrazine water concentrations. Applications to the south Florida environment should be made with caution.

Bromacil: Bromacil is a terrestrial herbicide registered for use on pineapple, citrus, and non-crop areas. Environmental fate and toxicity data in Tables 3 and 4 indicate that bromacil (1) is easily lost from soil by leaching, with moderate loss from surface adsorption or surface solution; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Additional fish toxicity data includes a 96 hour LC_{50} of 164 mg/L for carp (Hartley and Kidd, 1987). The highest concentration of bromacil detected in the surface water during this sampling event was at L3BRS (0.32 μg/L). Using these criteria, these levels should not have an acute or chronic detrimental impact on fish.

Chlorpyrifos ethyl: Chlorpyrifos ethyl is a non-systemic insecticide with contact, stomach, and respiratory action, for use on citrus, vegetables, rice, and household insect pests (Hartley and Kidd, 1987). Environmental fate and toxicity data in Tables 3 and 4 indicate that: chlorpyrifos ethyl (1) is not readily lost from soil by leaching, with moderate loss from surface adsorption or surface solution; (2) is toxic to mammals and fish; and (3) bioconcentrates to a limited extent. The only concentration of chlorpyrifos ethyl found in this sampling event (0.085 μg/L at S2) should not have an acute, harmful impact on fish. However, for aquatic invertebrates, these levels are greater than the calculated acute and chronic toxicity (0.03 and 0.005 μg/L, respectively) for *Daphnia magna*. At this level, exposure can cause impacts to macroinvertebrate populations, but the pulsed nature of agricultural runoff releases to the canal system precludes drawing any conclusions about the effects of long term average exposures.

Diazinon: Diazinon is a non-systemic insecticide and acaricide registered for use on a wide range of crops including citrus, bananas, vegetables, potatoes, sugarcane, rice and ornamentals. Environmental fate and toxicity data in Tables 3 and 4 indicate that diazinon (1) is easily lost from soil by surface solution, with a moderate loss from leaching, and minimum loss from

surface adsorption; (2) is slightly toxic to mammals and relatively toxic to fish; and (3) does not bioaccumulate significantly. The only diazinon concentration detected (0.053 μg/L at S2), should not have an acute, detrimental impact on fish. However, for aquatic invertebrates, these levels are slightly greater than the calculated chronic toxicity (0.04 μg/L) for Daphnia magna. At this level, exposure can cause impacts to macroinvertebrate populations, but the pulsed nature of agricultural runoff releases to the canal system precludes drawing any conclusions about the effects of long term average exposures.

Diuron: Diuron is a selective, systemic terrestrial herbicide registered for use on sugarcane, bananas, and citrus. Environmental fate and toxicity data in Tables 3 and 4 indicate that diuron (1) is easily lost from soil in surface solution, with moderate loss from leaching or surface adsorption; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Additional fish toxicity data includes a 96-hour LC_{50} of 25 mg/L for guppies (Hartley and Kidd, 1987). Crustaceans are affected at lower concentrations with a 48 hour LC_{50} of 1.4 mg/L for water fleas and a 96 hour LC_{50} of 0.7 mg/L for water shrimp (Verschueren, 1983). Most algal effects occur at concentrations > 10 μg/L (Verschueren, 1983). The only surface water concentration of diuron found during this sampling event was 0.42 μg/L (Table 2). Using these criteria, this level should not have an acute, harmful impact on fish or algae.

Ethion: Ethion is a non-systemic acaricide and insecticide registered for use on several fruits, citrus, and vegetables. The use of ethion on citrus has been cancelled (Federal Register, March 22, 2002). By December 31, 2004, all use of existing stocks of the end-use products is prohibited. Environmental fate and toxicity data in Tables 3 and 4 indicate that ethion (1) is strongly sorbed to soil and therefore can accumulate in sediments; (2) is slightly toxic to mammals, relatively toxic to fish and extremely toxic to Daphnia; and (3) bioconcentrates to a limited extent. Several sources of toxicity information have shown both agreement and disagreement of these laboratory tests. The ethion concentration of 0.023 at GORDYRD exceeds the acute and chronic toxicity level (0.02 and 0.003 μg/L, respectively) for *Daphnia magna* calculated according to promulgated procedure (FAC 62-302.200). *Daphnia magna* is a sensitive indicator species for aquatic macroinvertebrates. At this level, exposure can cause impacts to macroinvertebrate populations, but the pulsed nature of agricultural runoff releases to the canal system precludes drawing any conclusions about the effects of long term average exposures. With the method detection limit around 0.019 μg/L, any detection will automatically exceed the calculated chronic toxicity (0.003 μg/L) for *Daphnia magna*.

Hexazinone: Hexazinone is a non-selective contact herbicide that inhibits photosynthesis. Registered uses include sugarcane, pineapple, and non-crop areas. Environmental fate and toxicity data in Tables 3 and 4 indicate that hexazinone (1) is easily lost from soil by leaching, with moderate loss from surface adsorption or surface solution; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Hexazinone is practically non-toxic to freshwater invertebrates with an EC_{50} of 145 mg/l for *Daphnia magna* (U.S. Environmental Protection Agency, 1988). The highest surface water concentration detected in this sampling event at C25S99 (0.26 μg/L) should not have an acute impact on fish or aquatic invertebrates.

Metalaxyl: Metalaxyl is a systemic fungicide. Registered uses include potatoes, strawberries, citrus, avocados and vegetables. Environmental fate and toxicity data in Tables 3 and 4 indicate that metalaxyl (1) is easily lost from soil by leaching and has a moderate potential for loss due to surface adsorption and surface solution; (2) is relatively non-toxic to mammals and fish; and (3) does not bioaccumulate significantly. The only concentration of metalaxyl detected was 0.090 µg/L at CR33.5T (Table 2). Using these criteria, the concentrations of metalaxyl detected should not have an acute, harmful impact on fish or aquatic invertebrates.

Norflurazon: Norflurazon is a selective herbicide registered for use on many crops including citrus. Environmental fate and toxicity data in Tables 3 and 4 indicate that norflurazon (1) is easily lost from soil surface solution and a moderate potential for loss due to leaching and surface adsorption; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. The LC_{50} for norflurazon is >200 mg/L for catfish and goldfish (Hartley and Kidd, 1987). The norflurazon surface water concentrations ranged from 0.031 to 0.70 µg/L. Even at the highest concentration, this is several orders of magnitude below the calculated chronic action level. Using these criteria, these levels should not have an acute, detrimental impact on fish or aquatic invertebrates.

Prometon: Prometon is a non-selective systemic herbicide registered for use in non-crop areas. Environmental fate and toxicity data in Tables 3 and 4 indicate that prometon (1) is easily lost from soil by leaching, with moderate loss from surface adsorption or surface solution; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. The highest concentration of prometon detected (0.025 µg/L at NSIDWC07) is several orders of magnitude below the calculated chronic action level. Using these criteria, these levels should not have an acute, detrimental impact on fish or aquatic invertebrates.

Simazine: Simazine is a selective systemic herbicide registered for use on many crops including sugarcane, citrus, corn, and non-crop areas. Environmental fate and toxicity data in Tables 3 and 4 indicate that simazine (1) is easily lost from soil by leaching and has a moderate potential for loss due to surface adsorption and surface solution; (2) is relatively non-toxic to mammals and fish; and (3) does not bioconcentrate significantly. Additional fish toxicity data include a 96 hour LC_{50} of 49 mg/L for guppies (Hartley and Kidd, 1987). Most of the aquatic biological effects occur at concentrations > 500 µg/L (Verschueren, 1983). Aquatic invertebrate LC_{50} toxicity ranges from 3.2 mg/L to 100 mg/L for simazine (U.S. Environmental Protection Agency, 1984). The highest surface water concentration of simazine was detected at L3BRS (0.14 µg/L), below any level of concern for fish or aquatic invertebrates.

Quality Assurance Evaluation

Replicate samples were collected at sites S3 and S332. All the analytes detected in the surface water had precision ≤ 30% RPD. No analytes were detected in the field blanks collected at S2, S332, and S38B. All samples were shipped and all bottles were received.

Low concentrations of representative analytes from each pesticide group/method were added to laboratory water as well as to samples submitted. The matrix spike recoveries for azinphos methyl did not meet the specified requirements for the surface water samples collected at the

following locations: S79, CR33.5T, S78, S235, FECSR78, S65E, S38B (including replicate) NSIDWC06, NSIDWC07, S6, S5A, ACME1DS, and G94D. For samples collected at S38B, (including field duplicate), NSIDWC06, NSIDWC07, S6, S5A, ACME1DS, and G94D, the chlorophenoxy herbicides analysis were flagged due to exceeding holding time during sample preparation. The remainder of the analytes for each sample adhered to the targets for precision and accuracy as outlined in the FDEP Comprehensive Quality Assurance Plan. Organic quality assurance targets are set according to historically generated data or are adapted from the U.S. Environmental Protection Agency with slight modifications or internal goals, based on FDEP limited data. Parameters with low or high recoveries indicate that the sample matrix interferes with these analyses and interpretation of the respective analytical results should consider this effect.

Glossary

LD_{50}: The dosage which is lethal to 50% of the terrestrial animals tested within a short (acute) exposure period, usually 24 to 96 hours.

LC_{50}: A concentration which is lethal to 50% of the aquatic animals tested within a short (acute) exposure period, usually 24 to 96 hours.

EC_{50}: A concentration necessary for 50% of the aquatic species tested to exhibit a toxic effect short of mortality (e.g., swimming on side or upside down, cessation of swimming) within a short (acute) exposure period, usually 24 to 96 hours.

Koc: The soil/sediment partition or sorption coefficient normalized to the fraction of organic carbon in the soil. This value provides an indication of the chemical's tendency to partition between soil organic carbon and water.

Bioconcentration Factor:
The ratio of the concentration of a contaminant in an aquatic organism to the concentration in water, after a specified period of exposure via water only. The duration of exposure should be sufficient to achieve a near steady-state condition.

Soil or water half-life:
The time required for one-half the concentration of the compound to be lost from the water or soil under the conditions of the test.

MDL: The minimum concentration of an analyte that can be detected with 99% confidence of its presence in the sample matrix.

PQL: The lowest level of quantitation that can be reliably achieved within specified limit of precision and accuracy during routine laboratory operating conditions. The PQL is further verified by analyzing spike concentrations whose relative standard deviation in 20 fortified water samples is < 15%. In general, the PQL is 2 to 5 times larger than the MDL.

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Figure 1. South Florida Water Management District Pesticide Monitoring Network.

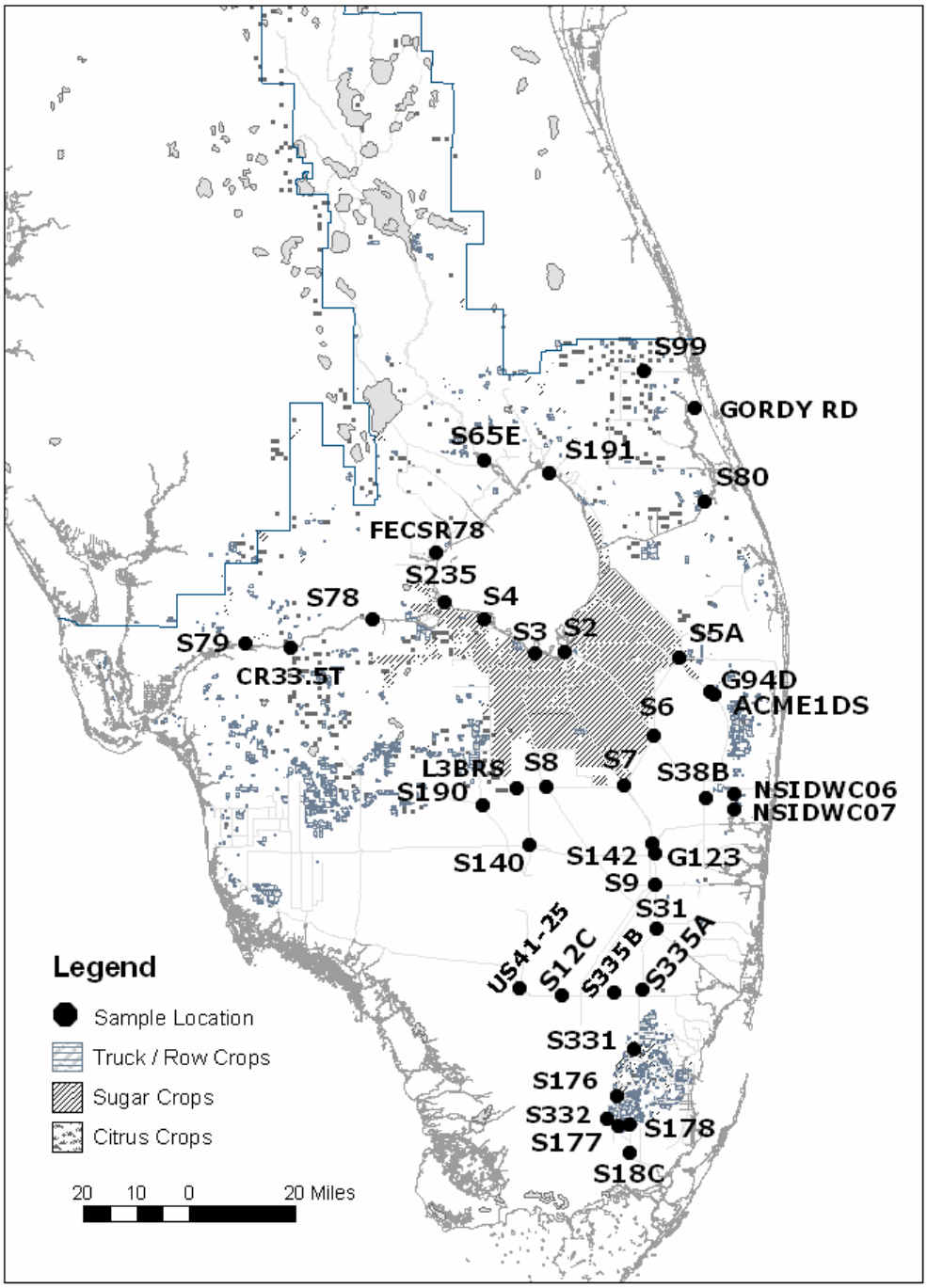

Table 1. Minimum detection limits (MDL) and practical quantitation limits (PQL) for pesticides analyzed in September 2002.

Pesticide or metabolite	Water Range of MDL-PQL (µg/L)	Pesticide or metabolite	Water Range of MDL-PQL (µg/L)
2,4-D	0.8 - 3.2	β-endosulfan (beta)	0.0038 - 0.0164
2,4,5-T	0.8 - 3.2	endosulfan sulfate	0.0019 - 0.0184
2,4,5-TP (silvex)	0.8 - 3.2	endrin	0.019 - 0.08
alachlor	0.047 - 0.204	endrin aldehyde	0.0042 - 0.018
aldrin	0.0019 - 0.0088	ethion	0.019 - 0.08
ametryn	0.0094 - 0.04	ethoprop	0.019 - 0.08
atrazine	0.0094 - 0.04	fenamiphos (nemacur)	0.028 - 0.124
atrazine desethyl	0.0094 - 0.04	fonofos (dyfonate)	0.019 - 0.08
atrazine desisopropyl	0.0094 - 0.04	heptachlor	0.0023 - 0.0096
azinphos methyl (guthion)	0.019 - 0.08	heptachlor epoxide	0.0019 - 0.008
α-BHC (alpha)	0.0021 - 0.0088	hexazinone	0.019 - 0.08
β-BHC (beta)	0.0032 - 0.014	imidacloprid	0.2 - 0.4
δ-BHC (delta)	0.0019 - 0.0088	linuron	0.2 - 0.4
γ-BHC (gamma) (lindane)	0.0019 - 0.008	malathion	0.028 - 0.124
bromacil	0.038 - 0.164	metalaxyl	0.047 - 0.204
butylate	0.019 - 0.08	methoxychlor	0.0098 - 0.044
carbophenothion (trithion)	0.015 - 0.064	metolachlor	0.057 - 0.244
chlordane	0.0094 - 0.076	metribuzin	0.019 - 0.08
chlorothalonil	0.015 - 0.064	mevinphos	0.057 - 0.308
chlorpyrifos ethyl	0.019 - 0.08	mirex	0.011 - 0.048
chlorpyrifos methyl	0.0094 - 0.04	naled	0.075 - 0.328
cypermethrin	0.019 - 0.08	norflurazon	0.019 - 0.08
DDD-P,P’	0.0045 - 0.0196	parathion ethyl	0.019 - 0.08
DDE-P,P’	0.0038 - 0.0164	parathion methyl	0.019 - 0.08
DDT-P,P’	0.0038 - 0.0164	PCB	0.019 - 0.08
demeton	0.11 - 0.48	permethrin	0.015 - 0.064
diazinon	0.019 - 0.08	phorate	0.028 - 0.124
dicofol (kelthane)	0.042 - 0.18	prometryn	0.019 - 0.08
dieldrin	0.0019 - 0.008	prometon	0.019 - 0.08
disulfoton	0.019 - 0.08	simazine	0.0094 - 0.04
diuron	0.2 - 0.4	toxaphene	0.071 - 0.384
α-endosulfan (alpha)	0.0038 - 0.0164	trifluralin	0.0075 - 0.0328

Table 2. Summary of pesticide residues above the method detection limit found in surface water samples collected in September 2002.

Date	Site	Flow	ametryn	atrazine	atrazine desethyl	atrazine desisopropyl	bromacil	chlorpyrifos ethyl	diazinon	diuron	ethion	hexazinone	metalaxyl	norflurazon	prometon	simazine	Number of compounds detected at site
9/16/2002	S12C	Y	-	0.032 I	-	-	-	-	-	-	-	-	-	-	-	-	1
	S176	N	-	0.013 I	-	-	-	-	-	-	-	-	-	-	-	-	1
	S177	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	S178	N	-	-	-	0.012 I	-	-	-	-	-	-	-	-	-	-	1
	S18C	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	S331	Y	-	0.011 I	-	-	-	-	-	-	-	-	-	-	-	-	1
	S332	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	S355A	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	S355B	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	US41-25	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
9/17/2002	C25S99	Y	-	-	-	-	0.19	-	-	-	-	0.26	-	0.65	-	0.019 I	4
	G123	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	GORDYRD	Y	-	-	-	-	0.20	-	-	-	0.023 I	-	-	0.70	-	0.065	4
	L3BRS	Y	-	-	-	0.031 I	0.32	-	-	-	-	-	-	0.18	-	0.14	4
	S140	Y	-	-	-	-	-	-	-	-	-	0.033 I	-	0.063 I	-	-	2
	S142	N	0.017 I	0.032 I	-	-	-	-	-	-	-	-	-	-	-	-	2
	S190	Y	-	-	-	-	-	-	-	-	-	-	-	0.048 I	-	0.011 I	2
	S2	N	-	0.11	-	-	-	0.085	0.053 I	-	-	-	-	-	-	-	3
	S3	N	0.041 *	0.090 *	0.0096 I*	-	-	-	-	-	-	-	-	-	-	-	3
	S31	N	-	0.048	-	-	-	-	-	-	-	-	-	-	-	-	1
	S4	N	0.062	0.093	0.015 I	-	-	-	-	-	-	0.030 I	-	-	-	-	4
	S7	N	0.0099 I	0.0098 I	-	-	-	-	-	-	-	-	-	-	-	-	2
	S8	N	-	-	-	-	-	-	-	-	-	-	-	0.031 I	-	-	1
	S80	Y	-	0.11	0.029 I	-	-	-	-	-	-	-	-	0.14	-	0.027 I	4
	S9	Y	-	0.063	-	-	-	-	-	-	-	-	-	-	-	-	1
9/18/2002	ACME1DS	N	0.047	0.073	-	-	-	-	-	-	-	-	-	-	-	-	2
	CR33.5T	N	-	0.090	0.021 I	0.015 I	-	-	-	0.42	-	-	0.090 I	0.66	-	0.060	7
	FECSR78	Y	-	-	-	-	-	-	-	-	-	0.077	-	-	-	-	1
	G94D	N	0.039	0.093	-	-	-	-	-	-	-	-	-	-	-	-	2
	NSIDWC06	N	-	0.37	0.046	-	-	-	-	-	-	-	-	-	-	-	2
	NSIDWC07	N	0.025 I	0.66	-	0.010 I	-	-	-	-	-	-	-	-	0.025 I	-	4
	S235	R	-	0.070	-	-	-	-	-	-	-	0.027 I	-	-	-	-	2
	S38B	N	0.012 I	0.90	0.11	0.010 I	-	-	-	-	-	-	-	-	0.022 I	-	5
	S5A	Y	0.012 I	0.15	0.022 I	-	-	-	-	-	-	-	-	-	-	-	3
	S6	N	0.12	0.030 I	-	-	-	-	-	-	-	-	-	-	-	-	2
	S65E	Y	-	0.049	-	-	-	-	-	-	-	-	-	-	-	-	1
	S78	Y	-	0.057	-	-	-	-	-	-	-	-	-	0.034 I	-	-	2
	S79	Y	-	0.045	-	-	-	-	-	-	-	-	-	0.21	-	0.066	3
Total number of compound detections			10	23	7	5	3	1	1	1	1	5	1	10	2	7	

N - no Y - yes R - reverse; - denotes that the result is below the MDL; * results are the average of duplicate samples
I - value reported is less than the minimum quantitation limit, and greater than or equal to the minimum detection limit

Table 3. Selected properties of pesticides found in September 2002 sampling event.

common name	Surface Water Standards FAC 62-302 (µg/L)	Ground Water Guidance Conc. (µg/L)	LD50 acute rats oral (mg/kg) (1)	EPA carcinogenic potential	Water Solubility (mg/L) (2, 3)	Koc (mL/g) (2, 3)	soil half-life (days) (2, 3)	SCS rating (2) LE	SA	SS	Bioconcentration Factor (BCF)
ametryn	-	63	1110	D	185	300	60	M	M	M	33
atrazine	-	3**	3080	C	33	100	60	L	M	L	86
bromacil	-	90	5200	C	700	32	60	L	M	M	15
chlorpyrifos ethyl	-	21	135 - 163	D	2	6070	30	S	M	M	418
diazinon	-	6.3	240 - 480	E	40	570	40	M	S	L	77
diuron	-	14	3400	D	42	480	90	M	M	L	75
ethion	-	3.5	208	-	1.1	8900	150	S	L	M	586
hexazinone	-	231	1690	D	33000	54	90	L	M	M	2
metalaxyl	-	420	669	-	7100	100	70	L	M	M	4
norflurazon	-	280	9400	C	28	700	90	M	M	L	94
prometon	-	105	2980	-	720	200	500	L	M	M	15
simazine	-	4**	>5000	C	6.2	130	60	L	M	M	221

SCS Ratings are pesticide loss due to leaching (LE), surface adsorption (SA) or surface solution (SS) and grouped as large(L), medium (M), small (S) or extra small (XS)

Bioconcentration Factor (BCF) calculated as BCF = 10^(2.791 - 0.564 log WS) (4)

B2: probable human carcinogen; C: possible human carcinogen; D: not classified; E: evidence of non-carcinogen for humans (5)

FDEP surface water standards for Class III waters except Class I in ( )

** primary standard

(1) Hartley, D. and H. Kidd. (Eds.) (1987). The Agrochemicals Handbook. Second Edition, The Royal Society of Chemistry. Nottingham, England.

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(3) Montgomery, J.H. (1993). Agrochemicals Desk Reference: Environmental Data. Lewis Publishers. Chelsa, MI.

(4) Lyman,W.J., W.F. Reehl, and D.H. Rosenblatt. (1990). Handbook of Chemical Property Estimation Methods. American Chemical Society, Washington, DC.

(5) U.S. Environmental Protection Agency (1996). Drinking Water Regulations and Health Advisories. Office of Water. EPA 822-B-96-002.

Toxicity 4. Toxicity of pesticides found in September 2002 sampling event to freshwater aquatic invertebrates and fishes (µg/L).

common name	48 hr EC50 Water flea *Daphnia magna*		acute toxicity (*)	chronic toxicity (*)	96 hr LC50 Fathead Minnow (#) *Pimephales promelas*		acute toxicity	chronic toxicity	96 hr LC50 Bluegill *Lepomis macrochirus*		acute toxicity	chronic toxicity	96 hr LC50 Largemouth Bass *Micropterus salmoides*		acute toxicity	chronic toxicity	96 hr LC50 Rainbow Trout (#) *Oncorhynchus mykiss*		acute toxicity	chronic toxicity	96 hr LC50 Channel Catfish *Ictalurus punctatus*		acute toxicity	chronic toxicity
ametryn	28,000	(6)	9333	1400	-		-	-	4,100	(4)	1367	205	-		-	-	8,800	(4)	2933	440	-		-	-
atrazine	6900	(6)	2300	345	15,000	(6)	5000	750	16,000	(4)	5333	800	-		-	-	8,800	(4)	2933	440	7,600	(4)	2533	380
bromacil	-		-	-	-		-	-	127,000	(6)	42333	6350	-		-	-	36,000	(6)	12000	1800	-		-	-
chlorpyrifos ethyl	1.7	(6)	0.57	0.085	203	(6)	68	10	2.6	(4)	0.87	0.13	-		-	-	11	(4)	3.7	0.55	280	(6)	93	14
	0.1	(6)	0.03	0.005	-		-	-	5.8	(6)	1.93	0.29	-		-	-	-		-	-	-		-	-
diazinon	0.8	(1)	0.3	0.04	7,800	(6)	2600	390	168	(1)	56	8.4	-		-	-	90	(1)	30	4.5	-		-	-
	0.9	(3)	0.3	0.045	-		-	-	165	(2)	55	8.3	-		-	-	1,650	(2)	550	83	-		-	-
	-		-	-	-		-	-	16,000	(4)	5333	800	-		-	-	2,900	(4)	967	145	-		-	-
diuron	1,400	(6)	467	70	14,200	(6)	4733	710	5,900	(4)	1967	295	-		-	-	5,600	(4)	1867	280	-		-	-
ethion	0.06	(1)	0.02	0.003	720	(1)	240	36	210	(1)	70	11	173	(1)	58	9	500	(1)	167	25	7,600	(1)	2533	380
	-		-	-	-		-	-	13	(2)	4.3	0.65	150	(3)	50	8	193	(2)	64	10	7,500	(3)	2500	375
	-		-	-	-		-	-	22	(3)	7.3	1.1	-		-	-	560	(3)	187	28	-		-	-
hexazinone	151,600	(6)	50533	7580	274,000	(4)	91333	13700	100,000	(6)	33333	5000	-		-	-	180,000	(6)	60000	9000	-		-	-
metalaxyl	28,000	(6)	9333	1400	-		-	-	139,000	(6)	46333	6950	-		-	-	132,000	(6)	44000	6600	-		-	-
norflurazon	15,000	(6)	5000	750	-		-	-	16,300	(6)	5433	815	-		-	-	8,100	(6)	2700	405	>200,000	(4)	>67,000	>10,000
prometon	-		-	-	-		-	-	40,000	(5)	13333	2000	-		-	-	12,000	(5)	4000	600	-		-	-
simazine	1,100	(6)	367	55	100,000	(6)	33333	5000	90,000	(4)	30000	4500	-		-	-	100,000	(6)	33333	5000	-		-	-

(*) Florida Administrative Code (FAC) 62-302.200, for compounds not specifically listed, acute and chronic toxicity standards are calculated as one-third and one-twentieth, respectively, of the amount lethal to 50% of the test organisms in 96 hours, where the 96 hour LC50 is the lowest value which has been determined for a species significant to the indigenous aquatic community.

(#) Species is not indigenous. Information is given for comparison purposes only.

(1) Johnson, W. W. and M.T. Finley (1980). Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. U.S. Department of the Interior, Fish and Wildlife Service Resource Publication 137. Washington, DC.

(2) Schneider, B.A. (Ed.) (1979). Toxicology Handbook, Mammalian and Aquatic Data, Book 1: Toxicology Data. U.S. Environmental Protection Agency. U.S. Government Printing Office. Washington, DC. EPA-5400/9-79-003

(3) U.S. Environmental Protection Agency (1972). Effects of Pesticides in Water: A Report to the States. U.S. Government Printing Office. Washington, DC.

(4) Hartley, D. and H. Kidd. (Eds.) (1987). The Agrochemicals Handbook. Second Edition, The Royal Society of Chemistry. Nottingham, England.

(5) Montgomery, J.H. (1993). Agrochemicals Desk Reference: Environmental Data. Lewis Publishers. Chelsa, MI.

(6) U.S. Environmental Protection Agency (1991) Pesticide Ecological Effects Database, Ecological Effects Branch, Office of Pesticide Programs, Washington, DC.

Table 5. Atrazine Desethyl/Atrazine ratio (DAR) data for September, 2002.

Site	Flow	atrazine ug/l	moles/l	atrazine desethyl ug/l	moles/l	DAR
S3	N	0.090	4.17275E-10	0.0096	5.11641E-11	0.1
S4	N	0.093	4.31184E-10	0.015	7.99439E-11	0.2
S80	Y	0.11	5.10003E-10	0.029	1.54558E-10	0.3
CR33.5T	N	0.090	4.17275E-10	0.021	1.11922E-10	0.3
NSIDWC06	N	0.37	1.71546E-09	0.046	2.45161E-10	0.1
S38B	N	0.90	4.17275E-09	0.11	5.86256E-10	0.1
S5A	Y	0.15	6.95458E-10	0.022	1.17251E-10	0.2
			DAR	**All sites**	**Flow only sites**	**No flow sites**
			average	0.2	0.2	0.2
			median	0.2	0.2	0.1
			minimum	0.1	0.2	0.1
			maximum	0.3	0.3	0.3